Application No. 10/723,397
Amendment Date June 25, 2007; Reply to Office Action of April 4, 2007

Remarks/Arguments

Applicant appreciates the helpful feedback and guidance received from Examiner Bitar in the "Detailed Action" section. The abstract and claims are amended to respond to the office communication.

Specification

Applicant appreciates Examiner Bitar's helpful guidance. The abstract is amended to be a <u>single</u> paragraph within the range of <u>50</u> to <u>150</u> words. It no longer repeats information given in the title.

Claim Rejections – 35 USC §103

Applicant appreciates Examiner Bitar's helpful guidance. Applicant has reviewed Kurosawa et al (U.S. Patent 4,972,499), McConnell (U.S. Patent 4,567,610) and Silver et al (U.S. Patent 7,164,796). Even though the prior arts may appear to be related to the subject matter sought to be patented. Upon careful reviewed. It becomes clear that the subject matters of the current invention are not covered by the prior arts even in its best combination.

- Kurosawa focuses on pattern recognition rather than high precision matching. Its detailed recognition module is for ambiguity character recognition rather than sub-pixel high precision matching.
- McConnell teaches invariant pattern search but not for high precision match. The histograms of different mapping regions could be independent of orientation and shape of object but it is the crudest representation of data, which is good for coarse but not high precision matching.
- Silver's "perfect fit" method <u>teaches away</u> "digital image re-sampling" method. Instead, it teaches the use of vector-valued features because it cannot overcome digital grid quantization error inherent in the prior art method. It further teaches away of two stage approach since there is inherently no concept of coarse and fine matching in the vector-valued feature matching. Since Silver teaches away the digital image based matching method, it is not obvious for a person having ordinary skill of art to seek combination of the Kurosawa or McConnell with Silver due to the mis-match of prior arts.

Our current invention uses digital image representation yet it does not require and suffer any re-sampling error. This is because

1. We create matching function of subpixel values or invariant high precision parameters

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2. The subpixel values or invariant high precision parameters can be estimated by image interpolation and interpolation parameter optimization.
3. The interpolation parameter optimization can be performed by an unique and efficient iterative matching function maximization.

Furthermore, using our invention, the same template can be used for initial matching and for the high precision matching.

Applicant realize that we could improve the claims to clearly reflects the current invention. Claims 5, 8, 13, 18, 22 are cancelled. Independent claims 1, 14, 17 and 20 are amended. In addition, claims 2, 6, 7, 9, 10, 11, 19, 24, 26 and 27 are also amended. The amended claims added limitations reflecting the current invention that overcomes the cited prior arts. The applicant respectfully responds as follows:

Claim 1
(1) Added "based on a matching function of subpixel values or invariant high precision parameters" to Step (d) to clearly specify the use of special matching function for the high precision match.
(2) Added "same" template to clearly distinguish the invention and Kurosawa's detailed recognition requiring detailed recognition reference not the same as the main reference (Kurosawa Fig. 1).

Neither Kurosawa nor McConnell or Silver teach the use of matching function of subpixel values or invariant high precision parameters. Neither do they teach the use of the same template for high precision match.

Applicants respectfully submit that the amended claim 1 clearly specifies the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver.

Claim 2
We added the estimation of "subpixel values or invariant" high precision parameters to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver. Note that Silver's coordinate transformation is NOT matching interpolation.

Claims 3 – 4
Silver admitted that no general rule can be applied for settings of parameters (Column 14 lines 2-3). The Silver column 14 lines 52/57 discussed the number of bits in pixel representation for angle precision. It is not related to the match within or beyond one pixel range.

Applicants respectfully submit that the amended claim 1 further clarifies the invention of claims 3-4.

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Claim 5
Canceled

Claim 6
We added the robust matching limits pixel contribution "with maximum allowable value for a pixel" to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver. Note that Silver declared limitation of gray-level pixel grid based methods. It does not teach the robust matching limiting pixel contribution.

Claim 7
We added the robust matching performs pixel weighting "for variance and covariance calculation" to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver. Note that Silver assign weights for image feature based on the alignment of the direction of image feature and pattern field. It is specific to image dipole that is limited to the vector based method.

Claim 8
Canceled

Claim 9
We added "rather than the input image" to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver.

Claim 10
We added "in addition to the template image" to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver. Note that Silver uses different parameters for feature extraction such as low pass filtering, sub-sampling amount, noise thresholding since the vector-based method is totally different from the current invention.

Claim 11
We added "for the subpixel values or invariant high precision parameters" to clearly specify the essence of the invention that is unanticipated by the combination of Kurosawa, McConnell and Silver. Note that Silver's figures 22-25 are not related to the matching function maximization of the current invention.

Claim 12
Applicants respectfully submit that the amended claim 11 clarifies the invention of claims 12.

Claim 13
Canceled

Claim 14

Applicants respectfully submit that the same response as claim 1 applies.

Claims 15 - 16
Applicants respectfully submit that the same response as claims 3-4 applies.

Claim 17
Applicants respectfully submit that the same response as claim 1 applies.

Claim 18
Canceled

Claim 19
Applicants respectfully submit that the same response as claim 9 applies.

Claim 20
Applicants respectfully submit that the same response as claim 1 applies.

Claim 21
Applicants respectfully submit that the amended claim 20 clarifies the invention of claim 21.

Claim 22
Canceled

Claim 23
Applicants respectfully submit that the amended claim 20 clarifies the invention of claim 23.

Claim 24
Applicants respectfully submit that the same response as claim 11 applies.

Claim 25
Applicants respectfully submit that the same response as claim 12 applies.

Claim 26
Applicants respectfully submit that the same response as claim 9 applies.

Claim 27
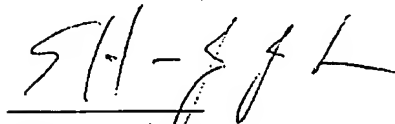Applicants respectfully submit that the same response as claim 10 applies.

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Conclusion

In view of the above remarks and arguments, applicant submits that the amendments to the abstract assure the compliance and the amendments to claims overcome claim rejections under 35 USC §103. Therefore applicant submits that this application is in condition for allowance, which action applicant respectfully solicits.

Conditional Request for Constructive Assistance

If for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner pursuant to MPEP para. 707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Respectfully submitted,

Shih-Jong J. Lee